

What is claimed is:

1. A control system for a remote-controlled vehicle, the control system comprising:
an electromagnetic energy receiver configured to receive an electromagnetic
beam, the electromagnetic energy receiver including:
5 an electromagnetic energy converter configured to convert energy
received from the electromagnetic beam and generate electrical power;
and
a beam position sensor configured to generate a control signal indicative
of a position of the electromagnetic energy receiver relative to a
10 position of the electromagnetic beam and generate a control; and
a propulsion control system configured to receive at least some of the electrical
power and the control signal and further configured to generate propulsion
commands to direct the vehicle to the position of the electromagnetic beam.
2. The system of Claim 1, wherein the electromagnetic energy receiver includes at
15 least one photoelectric cell configured to generate electrical power when subjected to
application of electromagnetic energy.
3. The system of Claim 2, wherein the photoelectric cell includes a solar cell.
4. The system of Claim 1, wherein the electromagnetic energy receiver is configured
to receive an externally-applied laser signal.
- 20 5. The system of Claim 1, wherein the electromagnetic energy receiver includes an
electromagnetic receiving array including a plurality of electromagnetic sensors, each of the
electromagnetic sensors being configured to generate a sensor output indicative of an
intensity of electromagnetic energy received by the electromagnetic sensor.
6. The system of Claim 5, wherein the propulsion control system is further configured
25 to receive the sensor output of each of the electromagnetic sensors.
7. The system of Claim 6, wherein the propulsion control system is further configured
to generate propulsion commands directed to maneuvering the vehicle to generally equalize
the sensor output of each of the electromagnetic sensors by maneuvering the remote-
controlled vehicle such that the electromagnetic beam is received toward a center of the
30 electromagnetic receiving array.

8. The system of Claim 7, wherein the propulsion control system is further configured to generate propulsion commands directed to maneuvering the remote-controlled vehicle relative to the source of the electromagnetic beam such that the remote-controlled vehicle maintains a predetermined distance from the source of the electromagnetic beam.

5 9. The system of Claim 8, wherein the propulsion control system is further configured to receive external commands for adjusting a response to the electromagnetic beam.

10. The system of Claim 1, wherein the remote-controlled vehicle includes an airborne vehicle.

10 11. The system of Claim 10, wherein the propulsion control system is further configured to maintain the airborne vehicle at a level attitude.

12. The system of Claim 10, further comprising a propulsion system including at least one rotor disposed to generate lift.

15 13. The system of Claim 12, wherein the propulsion control system is further configured to optimize a speed of the at least one rotor to optimize power consumption of the at least one rotor.

20 14. The system of Claim 12, wherein the propulsion system includes a plurality of individually controllable lift rotors, each of the individually controllable lift rotors being further configured to generate a variable quantity of thrust such that a composite thrust of the plurality of individually controllable lift rotors provides at least one of a lift and a thrust component in a direction generally perpendicular to the lift.

15. The system of Claim 10, wherein the propulsion system includes at least one rotor disposed to generate thrust in a direction generally perpendicular to the lift.

16. The system of Claim 10, wherein the airborne vehicle includes a hovering vehicle configured to generate sufficient lift to support the airborne vehicle aloft.

25 17. The system of Claim 10, wherein the airborne vehicle includes a lighter-than-air vehicle.

18. The system of Claim 1, wherein the remote-controlled vehicle includes a land-based vehicle.

19. The system of Claim 1, wherein the remote-controlled vehicle includes a water-based vehicle configured to operate at least one of on the surface or under the surface of a body of water.

20. The system of Claim 1, wherein the remote-controlled vehicle includes a space-based vehicle configured to operate in at least a partial vacuum.

21. The system of Claim 1, further comprising a plurality of auxiliary solar cells disposable on a surface of the remote-controlled vehicle, the plurality of auxiliary solar cells being configured to generate auxiliary electrical power from ambient light.

22. The system of Claim 21, wherein the propulsion control system is further configured to generate propulsion commands to bring the remote-controlled vehicle to a controlled stop when contact with the electromagnetic beam is lost.

23. A remote-controlled vehicle comprising:

a vehicle housing;

an electromagnetic energy receiver coupled with the housing and configured to receive an electromagnetic beam, the electromagnetic energy receiver including:

an electromagnetic energy converter configured to convert energy received from the electromagnetic beam and generate electrical power; and

a beam position sensor configured to generate a control signal indicative of a position of the electromagnetic energy receiver relative to a position of the electromagnetic beam and generate a control;

a propulsion control system configured to receive at least some of the electrical power and the control signal and further configured to generate propulsion commands to direct the vehicle to the position of the electromagnetic beam; and

a propulsion system disposed in the housing, the propulsion system being further configured to receive the propulsion commands.

24. The vehicle of Claim 23, wherein the electromagnetic energy receiver includes at least one photoelectric cell configured to generate electrical power when subjected to application of electromagnetic energy.

25. The vehicle of Claim 24, wherein the photoelectric cell includes a solar cell.

26. The vehicle of Claim 23, wherein the electromagnetic energy receiver is configured to receive an externally-applied laser signal.

27. The vehicle of Claim 23, wherein the electromagnetic energy receiver includes an
5 electromagnetic receiving array including a plurality of electromagnetic sensors, each of the
electromagnetic sensors being configured to generate a sensor output indicative of an
intensity of electromagnetic energy received by the electromagnetic sensor.

28. The vehicle of Claim 27, wherein the propulsion control system is further
configured to receive the sensor output of each of the electromagnetic sensors.

10 29. The vehicle of Claim 28, wherein the propulsion control system is further
configured to generate propulsion commands directed to maneuvering the vehicle to
generally equalize the sensor output of each of the electromagnetic sensors by maneuvering
the remote-controlled vehicle such that the electromagnetic beam is received toward a center
of the electromagnetic receiving array.

15 30. The vehicle of Claim 29, wherein the propulsion control system is further
configured to generate propulsion commands directed to maneuvering the remote-controlled
vehicle relative to the source of the electromagnetic beam such that the remote-controlled
vehicle maintains a predetermined distance from the source of the electromagnetic beam.

20 31. The vehicle of Claim 30, wherein the propulsion control system is further
configured to receive external commands for adjusting a response to the electromagnetic
beam.

32. The vehicle of Claim 23, wherein the remote-controlled vehicle includes an
airborne vehicle.

25 33. The vehicle of Claim 32, wherein the propulsion control system is further
configured to maintain the airborne vehicle at a level attitude.

34. The vehicle of Claim 32, further comprising a propulsion system including at least
one rotor disposed to generate lift.

35. The vehicle of Claim 34, wherein the propulsion control system is further configured to optimize a speed of the at least one rotor to optimize power consumption of the at least one rotor.

36. The vehicle of Claim 34, wherein the propulsion system includes a plurality of individually controllable lift rotors, each of the individually controllable lift rotors being further configured to generate a variable quantity of thrust such that a composite thrust of the plurality of individually controllable lift rotors provides at least one of a lift and a thrust component in a direction generally perpendicular to the lift.

37. The vehicle of Claim 32, wherein the propulsion system includes at least one rotor disposed to generate thrust in a direction generally perpendicular to the lift.

38. The vehicle of Claim 32, wherein the airborne vehicle includes a hovering vehicle configured to generate sufficient lift to support the airborne vehicle aloft.

39. The vehicle of Claim 32, wherein the airborne vehicle includes a lighter-than-air vehicle.

40. The vehicle of Claim 23, wherein the remote-controlled vehicle includes a land-based vehicle.

41. The vehicle of Claim 23, wherein the remote-controlled vehicle includes a water-based vehicle configured to operate at least one of on the surface or under the surface of a body of water.

42. The vehicle of Claim 23, wherein the remote-controlled vehicle includes a space-based vehicle configured to operate in at least a partial vacuum.

43. The vehicle of Claim 23, further comprising a plurality of auxiliary solar cells disposable on a surface of the remote-controlled vehicle, the plurality of auxiliary solar cells being configured to generate auxiliary electrical power from ambient light.

44. The vehicle of Claim 43, wherein the propulsion control system is further configured to generate propulsion commands to bring the remote-controlled vehicle to a controlled stop when contact with the electromagnetic beam is lost.

45. A remote-controlled vehicle operation system comprising:
a remote-controlled vehicle including:

a vehicle housing;

an electromagnetic energy receiver coupled with the housing and configured to receive an electromagnetic beam, the electromagnetic energy receiver including:

an electromagnetic energy converter configured to convert energy received from the electromagnetic beam and generate electrical power; and

a beam position sensor configured to generate a control signal indicative of a position of the electromagnetic energy receiver relative to a position of the electromagnetic beam and generate a control;

a propulsion control system configured to receive at least some of the electrical power and the control signal and further configured to generate propulsion commands to direct the vehicle to the position of the electromagnetic beam; and

a propulsion system disposed in the housing, the propulsion system further configured to receive the propulsion commands; and

an electromagnetic beam generator configured to generate the electromagnetic beam.

46. The system of Claim 45, wherein the electromagnetic energy receiver includes at least one photoelectric cell configured to generate electrical power when subjected to application of electromagnetic energy.

47. The system of Claim 46, wherein the photoelectric cell includes a solar cell.

48. The system of Claim 45, wherein the electromagnetic energy receiver is configured to receive an externally-applied laser signal.

49. The system of Claim 45, wherein the electromagnetic energy receiver includes an electromagnetic receiving array including a plurality of electromagnetic sensors, each of the electromagnetic sensors being configured to generate a sensor output indicative of an intensity of electromagnetic energy received by the electromagnetic sensor.

50. The system of Claim 49, wherein the propulsion control system is further configured to receive the sensor output of each of the electromagnetic sensors.



51. The system of Claim 50, wherein the propulsion control system is further configured to generate propulsion commands directed to maneuvering the vehicle to generally equalize the sensor output of each of the electromagnetic sensors by maneuvering the remote-controlled vehicle such that the electromagnetic beam is received toward a center of the electromagnetic receiving array.

52. The system of Claim 51, wherein the propulsion control system is further configured to generate propulsion commands directed to maneuvering the remote-controlled vehicle relative to the source of the electromagnetic beam such that the remote-controlled vehicle maintains a predetermined distance from the source of the electromagnetic beam.

53. The system of Claim 52, wherein the propulsion control system is further configured to receive external commands for adjusting a response to the electromagnetic beam.

54. The system of Claim 45, wherein the remote-controlled vehicle includes an airborne vehicle.

55. The system of Claim 54, wherein the propulsion control system is further configured to maintain the airborne vehicle at a level attitude.

56. The system of Claim 54, further comprising a propulsion system including at least one rotor disposed to generate lift.

57. The system of Claim 56, wherein the propulsion control system is further configured to optimize a speed of the at least one rotor to optimize power consumption of the at least one rotor.

58. The system of Claim 56, wherein the propulsion system includes a plurality of individually controllable lift rotors, each of the individually controllable lift rotors being further configured to generate a variable quantity of thrust such that a composite thrust of the plurality of individually controllable lift rotors provides at least one of a lift and a thrust component in a direction generally perpendicular to the lift.

59. The system of Claim 54, wherein the propulsion system includes at least one rotor disposed to generate thrust in a direction generally perpendicular to the lift.

60. The system of Claim 54, wherein the airborne vehicle includes a hovering vehicle configured to generate sufficient lift to support the airborne vehicle aloft.

61. The system of Claim 54, wherein the airborne vehicle includes a lighter-than-air vehicle.

5 62. The system of Claim 45, wherein the remote-controlled vehicle includes a land-based vehicle.

63. The system of Claim 45, wherein the remote-controlled vehicle includes a water-based vehicle configured to operate at least one of on the surface or under the surface of a body of water.

10 64. The system of Claim 45, wherein the remote-controlled vehicle includes a space-based vehicle configured to operate in at least a partial vacuum.

65. The system of Claim 45, further comprising a plurality of auxiliary solar cells disposable on a surface of the remote-controlled vehicle, the plurality of auxiliary solar cells being configured to generate auxiliary electrical power from ambient light.

15 66. The system of Claim 65, wherein the propulsion control system is further configured to generate propulsion commands to bring the remote-controlled vehicle to a controlled stop when contact with the electromagnetic beam is lost.

67. The system of Claim 45, wherein the electromagnetic beam generator is a laser generator.

20 68. The system of Claim 67, wherein the laser generator generates a laser beam having a wavelength of approximately 1.064 μm .

25 69. A method for operating a remote-controlled vehicle, the method comprising:
receiving an electromagnetic beam;
converting the electromagnetic beam into electrical power to provide at least a portion of the power used by the remote-controlled vehicle;
determining a position to which the electromagnetic beam is directed; and
maneuvering the remote-controlled vehicle to align a position of the remote-controlled vehicle with the position to which the electromagnetic beam is directed.

70. The method of Claim 69, wherein the electromagnetic beam is received using at least one photoelectric cell configured to generate electrical power when subjected to application of electromagnetic energy.

71. The method of Claim 70, wherein the photoelectric cell includes a solar cell.

5 72. The method of Claim 71, wherein receiving the electromagnetic beam includes receiving an externally-applied laser signal.

73. The method of Claim 69, wherein the remote-controlled vehicle is maneuvered to follow the electromagnetic beam using a plurality of electromagnetic sensors, each of the electromagnetic sensors generating a sensor output indicative of an intensity of
10 electromagnetic energy received by the electromagnetic sensor from the electromagnetic beam.

74. The method of Claim 73, further comprising maneuvering the remote-controlled vehicle to generally equalize the sensor output of each of the electromagnetic sensors such that the electromagnetic beam is received generally evenly by the electromagnetic sensors.

15 75. The method of Claim 73, further comprising maneuvering the remote-controlled vehicle relative to the source of the electromagnetic beam such that the remote-controlled vehicle maintains a predetermined distance from the source of the electromagnetic beam.

76. The method of Claim 73, further comprising receiving external commands to adjust a response of the remote-controlled vehicle to the electromagnetic beam.

20 77. The method of Claim 69, wherein the remote-controlled vehicle includes an airborne vehicle.

78. The method of Claim 77, wherein the airborne vehicle includes a hovering vehicle configured to generate sufficient lift to support the airborne vehicle aloft.

25 79. The method of Claim 77, further comprising optimizing a speed of the at least one rotor to optimize power consumption of the at least one rotor.

80. The system of Claim 77, wherein the airborne vehicle includes a lighter-than-air vehicle.

81. The method of Claim 69, wherein the remote-controlled vehicle includes a land-based vehicle.

82. The method of Claim 69, wherein the remote-controlled vehicle includes a land-based vehicle.

5 83. The method of Claim 69, wherein the remote-controlled vehicle includes a water-based vehicle configured to operate at least one of on the surface and under the surface of a body of water.

84. The system of Claim 69, wherein the remote-controlled vehicle includes a space-based vehicle configured to operate in at least a partial vacuum.

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